WHAT IS CLAIMED IS:

1. A magnetic recording medium, comprising:

a substrate; and

a Co-containing spinel-type iron oxide thin film formed on the substrate, having a Co content of 1 to 20 mol% based on Fe, a coercive force value of not less than 159 kA/m (2,000 Oe), a thickness of 5 to 200 nm, a center line average height Ra of 0.1 to 0.8 nm and a maximum height (Rmax) of not more than 10 nm.

2. A magnetic recording medium according to claim 1, which further has a surface electrical resistance value of not more than 1.5 MΩ and a saturation magnetization value of 29 to 63 Wb/m^3 when measured by applying a magnetic field of 1,590 kA/m (20 kOe) thereto.

3. A magnetic recording medium according to claim 1, wherein said spinel-type iron oxide thin film comprises magnetite represented by the general formula of $FeO_x \cdot Fe_2O_3$ ($0 < x \leq 1$) and maghemite represented by the general formula of γ-Fe_2O_3.

4. A magnetic recording medium according to claim 1, further comprising an underlayer formed between the substrate and the Co-containing spinel-type iron oxide thin film, said underlayer having a thickness of not more than 200 nm and

being ones selected from the group consisting of an oxide thin film having a NaCl-type structure, a metal thin film having a bcc structure, a metal thin film having a B2 structure and an oxide thin film exhibiting an amorphous structure by X-ray analysis.

5. A magnetic recording medium according to claim 1, wherein said underlayer is ones selected from the group consisting of nickel oxide thin film, magnesium oxide thin film, chromium metal thin film, Cr-Mo alloy thin film, Ni-Al thin film, Fe-Al thin film, SiO_2 thin film and Al_2O_3 thin film.

6. A process for producing a magnetic recording medium, comprising:

forming a Co-containing iron oxide thin film on a substrate by sputtering a metal target or a metal alloy target in an atmosphere of plasma activated by an electron cyclotron resonance microwave.

7. A process according to claim 6, wherein the sputtering is conducted at a substrate temperature of 20 to 250°C under a gas pressure of 0.01 to 1.0 Pa.

8. A magnetic recording medium, comprising:

a substrate; and

a Co-containing spinel-type iron oxide thin film formed on the substrate, comprising magnetite represented by the

general formula of $\underline{FeO_x} \cdot Fe_2O_3$ ($0 < x \leq 1$) and maghemite represented by the general formula of γ-Fe_2O_3, and having a Co content of 1 to 20 mol% based on Fe, a coercive force value of not less than 159 kA/m (2,000 Oe), a thickness of 5 to 200 nm, a center line average height Ra of 0.1 to 0.8 nm, a maximum height (Rmax) of not more than 10 nm, a surface electrical resistance value of not more than 1.5 MΩ and a saturation magnetization value of 29 to 63 Wb/m^3 when measured by applying a magnetic field of 1,590 kA/m (20 kOe) thereto.

9. A magnetic recording medium, comprising:

a substrate;

an underlayer formed between the substrate and the Co-containing spinel-type iron oxide thin film, said underlayer having a thickness of not more than 200 nm and being ones selected from the group consisting of an oxide thin film having a NaCl-type structure, a metal thin film having a bcc structure, a metal thin film having a B2 structure and an oxide thin film exhibiting an amorphous structure by X-ray analysis; and

a Co-containing spinel-type iron oxide thin film formed on the underlayer, having a Co content of 1 to 20 mol% based on Fe, a coercive force value of not less than 159 kA/m (2,000 Oe), a thickness of 5 to 200 nm, a center line average height Ra of 0.1 to 0.8 nm and a maximum height (Rmax) of not more than 10 nm.